

**Appl. No.** : 09/411,143  
**Filed** : October 4, 1999

### **REMARKS**

The October 7, 2004 Office Action was based upon pending Claims 1-36. This amendment amends Claims 1, 6, 20, 34, 35, and 36, and cancels Claim 5. Thus, after entry of this Amendment, Claims 1-4 and 6-36 are pending and presented for further consideration.

In the October 7, 2004 Office Action, the Examiner rejected Claims 1-4 and 6-36 under 35 U.S.C. 103(a) as being unpatentable over Patent No. 5,999,630 ("the Iwamatsu patent") in view of U.S. Patent No. 4,739,514 ("the Short patent"). Further, the Examiner rejected Claim 5 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,208,493 ("the Lendaro patent") in view of U.S. Patent No. 5,400,405 ("the Petroff patent"). The Examiner further objected to the specification and the drawings.

### **THE SPECIFICATION**

The Examiner objected to the description of the pass-band and the stop-band in Figure 6C. Applicant has amended the specification to correct the description of the stop-band and the pass-band in Figure 6C. Applicant respectfully submits that no new matter is being introduced by way of this Amendment and requests that the foregoing Amendment to the specification be entered and made of record.

### **RESPONSE TO DRAWING OBJECTIONS**

The Examiner objected to the drawings, but the Examiner gave no further explanation. Applicant acknowledges the indication of drawing informality. Formal drawings will be prepared and filed upon issuance of a Notice of Allowance.

### **REJECTION OF CLAIMS 1-4 AND 6-36 UNDER U.S.C. 103(a)**

The Examiner rejected Claims 1-4 and 6-36 under 35 U.S.C. 103(a) as being unpatentable over Iwamatsu in view of Short.

**Claims 1, 6, 20, 34, 35, and 36**

Neither Iwamatsu nor Short teaches modulating the amplitude of a higher-frequency signal with a lower-frequency signal to produce an illusion of the lower-frequency signal to a listener when the sound is reproduced by loudspeakers.

In contrast, in an embodiment, the invention exploits how the human ear processes overtones and harmonics of low-frequency sounds to create the perception that non-existent low frequency sounds are being emitted from a loudspeaker. In some embodiments, the frequencies in higher-frequency bands are selectively processed to create the illusion of lower-frequency signals. In other embodiments, certain higher-frequency bands are modified with a plurality of filter functions. See page 7 line 29 through page 30 line 3 of the specification.

An embodiment of the invention overcomes the low-frequency limitations of small systems by using the characteristics of the human hearing system to produce the perception of low-frequency acoustic energy, even when such energy is not produced by the loudspeaker system. See page 30 lines 18-22 of the specification.

Referring to page 32 line 6 through page 33 line 7 of the specification:

"As shown in Figures 10 and 11, low-frequency acoustic energy comprising multiple tones or frequencies will produce, in the listener, the perception that the acoustic energy in the midbass range contains more spectral content than actually exists. The human brain, when faced with a situation where information is thought to be missing, will attempt to "fill in" missing information on a subconscious level. This filling in phenomenon is the basis for many optical illusions. In an embodiment of the present invention, the brain can be tricked into filling in low-frequency information that is not really present by providing the brain with the midbass effects of such low-frequency information.

In other words, if the brain is presented with the harmonics that would be produced by the ear if the low-frequency acoustic energy was present (e.g., the spectral line 1010) then under the right conditions, the brain will subconsciously fill in the low-frequency spectral lines 1006 and 1008 which it thinks "must" be present. This filling in process is augmented by another effect of the non-linearity of the human ear known as the detector effect.

The non-linearity of the human ear also causes the ear to act like a detector, similar to a diode detector in an Amplitude Modulation (AM) receiver. If a midbass harmonic tone is AM modulated by a deep bass tone, the ear will demodulate the modulated midbass carrier to reproduce the deep bass envelope. Figures 12A and 12B graphically illustrate the modulated and demodulated signal. Figure 12A shows, on a time axis, a

Appl. No. : 09/411,143  
Filed : October 4, 1999

modulated signal comprising a higher-frequency carrier signal (e.g. the midbass carrier) modulated by a deep bass signal.

The amplitude of the higher-frequency signal is modulated by a lower frequency tone, and thus, the amplitude of the higher-frequency signal varies according to the frequency of the lower frequency tone. The non-linearity of the ear will partially demodulate the signal such that the ear will detect the low-frequency envelope of the higher-frequency signal, and thus produce the perception of the low-frequency tone, even though no actual acoustic energy was produced at the lower frequency. As with the intermodulation effect discussed above, the detector effect can be enhanced by proper signal processing of the signals in the midbass frequency range. By using the proper signal processing, it is possible to design a sound enhancement system that produces the perception of low-frequency acoustic energy, even when using loudspeakers that are incapable of, or inefficient at, producing such energy." Emphasis added.

Thus, in an embodiment, the invention comprises a bass-enhancer configured to produce in a listener an illusion of low-frequency sound in an apparent sound stage by modulating the amplitude of a higher-frequency sound signal by a lower-frequency sound signal, even when the apparent sound stage is missing the low-frequency sound energy corresponding to the lower-frequency sound signal.

Because the references cited by the Examiner do not disclose, teach or suggest a bass enhancement module which modulates the amplitude of a higher-frequency signal with a lower-frequency signal to produce an illusion of the lower-frequency signal to a listener when the sound is reproduced by a plurality of loudspeakers, Applicant asserts that Claims 1, 6, 20, 34, 35, and 36 are not obvious in view of the Iwamatsu and Short references. Applicant therefore respectfully submits that Claims 1, 6, 20, 34, 35, and 36 are patentably distinguished over the cited references and Applicant respectfully requests allowance of Claims 1, 6, 20, 34, 35, and 36.

#### **Claims 2-4, 7-19, 21-33**

Claims 2-4, 7-19, and 21-33, which depend from Claims 1, 6, and 20, respectively, are believed to be patentable for the same reasons articulated above with respect to Claims 1, 6, and 20, respectively, and because of the additional features recited therein.

Appl. No. : 09/411,143  
Filed : October 4, 1999

**REJECTION OF CLAIM 5 UNDER U.S.C. 103(a)**

The Examiner rejected Claim 5 under 35 U.S.C. 103(a) as being unpatentable over Lendaro in view Petroff.

By this amendment, Applicants have canceled Claim 5 without prejudice or disclaimer. Accordingly, Applicants respectfully request the Examiner to withdraw the objection under U.S.C. 103(a).

**REQUEST FOR TELEPHONE INTERVIEW**

Pursuant to M.P.E.P. § 713.01, in order to expedite prosecution of this application, Applicants' undersigned attorney of record hereby formally requests a telephone interview with the Examiner as soon as the Examiner has considered the effect of the arguments presented above. Applicant's attorney can be reached at (949) 721-2998 or at the number listed below.

**CONCLUSION**

Applicants have endeavored to address all of the Examiner's concerns as expressed in the outstanding Office Action. In light of the above remarks, reconsideration and withdrawal of the outstanding rejections is specifically requested.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 12/7/04

By: John R. King  
John R. King  
Registration No. 34,362  
Attorney of Record  
Customer No. 20,995  
(949) 760-0404